

out of the meridian, owing to the paucity of meridian observations.

The proposed instrument would also be available for the determination of refraction, latitude, and systematic errors of N.P.D. by comparison of observations of stars and the Sun in different azimuths, and this would, in my view, be a very important application of the instrument. It would, in fact, enable us to determine with the accuracy of a meridian observation the fundamental places of stars under different instrumental and observational conditions, and thus to give independent determinations available for the discussion of refraction, latitude, and systematic errors generally.

When fixed in the meridian, this instrument would be to all intents and purposes a transit-circle, and could be used for all the ordinary meridian observations. I would propose that it should have a telescope of 8 inches aperture and of about 8 feet focal length, with two circles of 3 feet diameter each read by four microscopes, and that the reversing apparatus should lift it sufficiently high to give a clear view for the collimators, without perforation of the central portion, which should be made barrel-shaped, instead of in the usual form of a cube. The object-end and eye-end of the telescope tube should be precisely similar as regards strengthening diaphragms, and the object-glass and eyepiece micrometer should be readily interchangeable, the mode of attachment to the tube being the same for both.

Royal Observatory, Greenwich :
1892 May 12.

Note on the History of the Great Sun-spot of 1892 February.
By E. W. Maunder.

(Communicated by the Astronomer Royal.)

Although it was not until the month of 1892 February that this Sun-spot first attracted general attention, this was not its first appearance, for it had been seen during the three preceding months. It was first seen so far back as 1891 November 15, and was not finally lost to sight until 1892 March 17. And as it took its first rise, and underwent final dissipation, whilst in the invisible hemisphere, it was thus watched through the whole of five semi-rotations.

It was only during the February appearance that the group reached exceptional proportions, but during each of the other four appearances it was an important group, and during November it was decidedly above the average of spots at the present time as to size, and showed many features of interest. But the most remarkable feature in its history was the striking and persistent drift in latitude which it exhibited from its first appearance in 1891 November up to the time of its greatest

development in 1892 February. The following measures are complete at present only for the months of 1891 November and December. As no photographs for 1892 have been received as yet from the Solar Physics Committee, and 1892 January and February were very cloudy, the Greenwich record is very defective during those two months. Photographs were only obtained on seven days during the January appearance of the group, on six days during the period of its observation in February, and on ten days during that in March. The results, though thus imperfect, will be sufficient to render obvious this most unusual movement.

1891 November.

The group was seen on thirteen days during this month, and on each day one or more photographs were taken either at Greenwich or at one of the two co-operating observatories, Dehra Dûn and Mauritius.

November 15. A large spot, about 400 millionths in area, is seen close to the east limb.

November 16. The group now consists of three spots: two nearly in the same longitude, but differing in latitude, the third following the other two by about 5° of longitude.

November 17. The two preceding spots of November 16 now appear to be coalescing. A few faint spots and an arch of bright faculæ unite these preceding spots to the one which follows.

November 18. The group has now assumed the form, so typical of the more important disturbances, of a long procession of spots of various sizes, of which the first and last are by far the most considerable.

November 19. Usually in such cases the leading spot becomes very sharply defined and nearly circular in shape, and this takes place eventually in the case of the leader of the present group, but it passes through some curious changes first. On this day it shows itself as a large and most beautiful spot, as it is intersected by an intricate network of bright bridges.

November 20. The leader seems to show a tendency to assume a symmetrical shape, but it is strongly elliptical, instead of being circular.

November 21. The small spots in the middle of the group have nearly all disappeared, whilst both the leading and the last spots have greatly increased in size; the leader lengthening out instead of tending to become more nearly circular.

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November 22. The group now consists simply of two great spots; the leader very much elongated and intricate in shape; the following spot nearly circular and with very dark nucleus. The remarkable changes which the entire group underwent on these days were accompanied by a considerable magnetic disturbance; the needles showing a moderate amount of agitation from November 19^d 23^h (Greenwich Civil Time) to November 21^d 0^h, and again after a short period of quiescence, from November 21^d 6^h until November 22^d 2^h.

November 23. The group now begins to decline, the leading spot breaking up into a long chain of small spots, of which the leader, which is nearly circular in shape, is the best defined.

November 24. Of this chain of small spots, few except the leader now remain. The leader, however, has become larger and better defined, with a dark central umbra.

November 25. The group is again practically reduced to two spots, the smaller and fainter spots in the middle of the group having nearly all disappeared.

November 26. Only two spots now remain, and these are nearly of equal size. For the following spot of November 22 has been gradually diminishing in area whilst the preceding part of the group has been undergoing these remarkable changes.

November 27. The leader is now only seen as a shallow notch on the limb, too faint and shallow for accurate measurement, so that to a cursory view the following spot appears to be left alone.

The group was seen on the East limb on November 15, passed the central meridian on November 21^d 13^h₂ (Greenwich Civil Time), and reached the West limb on November 27.

Two small groups attended the great one during part of its course. Both were so near the great group as evidently to belong to the same general disturbance, and indeed the great spot of February was large enough to have included all the three groups of November within its area. Calling the group, the history of which we have just followed out, A, and these two minor groups B and C, the following notes briefly sum up their history.

Group B.

Appeared on November 15 as a scarcely perceptible pore, but was not seen on November 16. Reappeared on November 17, in advance of Group A in longitude, and on nearly the same

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parallel of latitude. It was only a small and insignificant group during this rotation, but was seen also during December.

Group C.

First seen on November 20 as a fairly important group. It had nearly the same longitude as Group A, but was considerably nearer the equator. It shared in the great change of Group A on November 22 and 23. For whilst on November 22 Group C had all but disappeared, on November 23 it was seen as a chain of small spots completely enclosing a large rhomboidal area, greater than the largest spot of Group A. By November 24 Group C had taken the typical form of a chain of small spots, the leader of which was the largest, and the most regular in form, whilst the following members of the group were quite faint and small.

The following tables give the mean heliographic positions of the centres of the groups during their successive appearances, together with their areas, as projected, and as corrected for foreshortening, the former being expressed in millionths of the Sun's apparent disc, the latter in millionths of the visible hemisphere.

Group A, 1891 November.

Date. Greenwich Civil Time.			Longitude from Central Meridian.	Heliographic Longitude from Prime Meridian.	Latitude.	Projected Area. Umbra.	Area. Whole Spot.	Area corrected for foreshortening. Umbra. Whole Spot.	
h	m	s							
Nov. 15	3	9	-84°1	260°9	-16°8	0	66	0	401
16	4	19	-69°0	262°2	-17°2	28	175	41	267
17	5	44	-55°2	262°1	-17°9	58	321	56	305
18	5	14	-44°0	260°3	-18°5	56	421	42	318
19	7	20	-28°4	261°7	-18°9	141	817	88	493
20	4	39	-17°6	260°7	-19°2	276	1369	156	773
21	4	23	- 5°0	260°2	-19°4	327	1898	178	1029
22	6	49	+ 9°5	260°3	-20°1	308	2115	171	1162
23	4	33	+20°9	259°7	-20°1	270	1564	160	909
24	5	14	+36°9	262°1	-20°9	208	1074	141	733
25	10	23	+50°9	262°1	-20°5	70	1002	154	908
26	11	35	+65°7	261°0	-20°1	63	456	81	609
27	5	32	+78°7	264°2	-20°4	46	252	72	719
Means			...	260°7	-19°1	103	634

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Group B, 1891 November.

	h	m	s							
Nov.	15	3	9	$-58^{\circ}7$	$287^{\circ}3$	$-20^{\circ}1$	0	2	0	2
	16	4	19
	17	5	44	$-32^{\circ}9$	$284^{\circ}4$	$-18^{\circ}4$	0	11	0	7
	18	5	14	$-19^{\circ}5$	$284^{\circ}8$	$-18^{\circ}9$	4	48	2	27
	19	7	20	$-8^{\circ}1$	$282^{\circ}0$	$-19^{\circ}3$	13	45	7	25
	20	4	49	$+6^{\circ}6$	$284^{\circ}9$	$-19^{\circ}1$	35	115	19	62
	21	4	23	$+18^{\circ}2$	$283^{\circ}4$	$-19^{\circ}0$	10	77	6	44
	22	6	49	$+34^{\circ}9$	$285^{\circ}7$	$-18^{\circ}2$	0	96	0	59
	23	4	33	$+45^{\circ}5$	$284^{\circ}3$	$-18^{\circ}4$	3	57	3	44
	24	5	14	$+63^{\circ}0$	$288^{\circ}2$	$-18^{\circ}5$	0	16	0	18
Means				...	$285^{\circ}0$	$-18^{\circ}8$	...	...	4	32

Group C, 1891 November.

	h	m	s							
Nov.	20	4	49	$-16^{\circ}8$	$261^{\circ}5$	$-11^{\circ}4$	22	120	13	65
	21	4	23	$-4^{\circ}0$	$261^{\circ}2$	$-12^{\circ}0$	0	30	0	15
	22	6	49	$+13^{\circ}2$	$264^{\circ}0$	$-11^{\circ}9$	0	41	0	21
	23	4	33	$+24^{\circ}4$	$263^{\circ}2$	$-10^{\circ}9$	27	170	15	96
	24	5	14	$+39^{\circ}0$	$264^{\circ}2$	$-11^{\circ}1$	46	315	30	207
	25	10	23	$+57^{\circ}7$	$266^{\circ}9$	$-10^{\circ}5$	26	182	25	175
	26	11	35	$+72^{\circ}6$	$267^{\circ}9$	$-10^{\circ}7$	12	57	20	96
	27	5	32	$+83^{\circ}4$	$268^{\circ}9$	$-10^{\circ}6$	0	53	0	244
Means				...	$264^{\circ}7$	$-11^{\circ}1$	...	...	13	115

1891 December.

Group A was first seen on December 12, crossed the central meridian on December 18^d 7^h, and reached the West limb on December 24. Its history during this appearance is soon told. It was a single well-defined circular spot, and it suffered very little change throughout the entire rotation.

Group B was not seen on December 12. It had not therefore persisted during the entire interval from its reaching the West limb on November 24, for had it done so it would have been seen on the East limb on December 11. But it soon formed again, and a very small spot was seen on December 13, two spots on December 15, and by December 16 the total area of the groups equalled that of the single spot which now represented Group A. On this day it showed a cluster of small spots in the preceding part of the group, and a large spot with a very dark umbra in the following part. The group had greatly increased in area by December 17, and from this time to the end of the rotation it was much larger than Group A. For the greater part of this period

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it consisted chiefly of two circular spots, either of which was larger than the spot which made up Group A.

Group C did not reappear in this rotation, but was represented on December 12 by a bright group of faculæ.

Group A, 1891 December.

Date, Greenwich Civil Time.			Longitude from Central Meridian.	Heliographic Longitude from Prime Meridian.	Latitude.	Projected Umbra.	Area. Whole Spot.	Area corrected for foreshortening. Umbra. Whole Spot.	
h	m	s							
Dec. 12	5	15	-80°1	267°9	-19°8	11	45	32	135
13	5	36	-67°7	266°9	-19°7	18	107	25	147
14	7	39	-52°2	268°2	-18°9	31	146	27	127
15	5	3	-40°9	267°7	-20°0	38	194	27	136
16	4	50	-27°8	267°7	-20°0	41	200	25	120
17	11	59	-11°1	267°3	-19°3	36	276	19	148
18	4	43	-1°3	267°9	-20°2	49	245	26	130
19	9	35	+14°7	268°1	-19°9	33	215	18	117
20	5	23	+28°5	267°5	-19°7	25	162	15	98
21	11	45	+41°8	267°7	-19°4	12	148	8	103
22	7	18	+52°7	267°9	-20°0	16	138	14	120
23	7	11	+63°7	265°8	-18°1	19	77	23	95
24	5	18	+77°6	267°5	-19°8	9	37	20	86
Means			...	267°5	-19°6	...	...	21	120

Group B, 1891 December.

h	m	s							
Dec. 13	5	36	-48°2	286°4	-18°6	0	13	0	11
14	7	39	-36°0	284°4	-17°7	0	3	0	2
15	5	3	-24°8	283°8	-20°1	0	47	0	28
16	4	50	-12°1	283°4	-20°0	56	200	28	99
17	11	59	+5°8	284°2	-19°1	134	715	71	376
18	4	43	+15°5	284°7	-19°8	161	742	88	408
19	9	35	+31°2	285°0	-19°2	117	871	72	534
20	5	23	+45°4	284°4	-18°7	46	548	33	404
21	11	45	+58°5	284°4	-18°3	39	394	39	390
22	7	18	+69°2	284°0	-19°0	20	218	27	315
23	7	11	+79°3	281°4	-18°2	12	52	35	157
Means			...	284°2	-18°9	...	...	36	248

1892 January.

The sun was photographed on only seven days at Greenwich during the January appearance of the group, and as no

photographs have as yet been received through the Solar Physics Committee from India or Mauritius, the daily record is still very incomplete. The group would appear to have crossed the central meridian on January 13^d 19^h, and to have reached the West limb on January 21.

It is not quite clear whether the group represented Group A or Group B, or whether it represented rather the general disturbance of which those two groups were indications. There can be no doubt but that A and B both belong to the same general disturbance, but if the January group represented one of the two rather than the other, it will probably have corresponded to Group B, inasmuch as it was moving in the direction of decreasing longitude throughout January, and its longitude was greater than that of A, but less than that of B.

The group on January 7 consists of a single large, well-defined spot. On January 8, when it has come further on the disc, some faint smaller spots are seen following it, and a small spot is seen to the north which appears to correspond to the Group C of the November appearance. By January 12 these faint companions of the principal spot have nearly disappeared, and on January 13, 14, and 16 the principal spot was seen alone. But a very striking change had occurred by January 20, for on that day the group consists of two large, well-defined spots, with a number of small spots connecting them. The imperfection of the record, owing to cloudy weather on January 17, 18, and 19, renders it impossible to say at present when and how this change took place.

Group B, 1892 January.

Date. Greenwich Civil Time.			Longitude from Central Meridian.	Heliographic Longitude from Prime Meridian.	Latitude.	Projected Area. Umbra.	Area. Whole Spot.	Area corrected for foreshortening. Umbra. Whole Spot.	
h	m	s							
Jan.	7	9 44	-81°2	281°0	-24°7	0	50	0	144
	8	10 26	-67°4	282°1	-24°6	33	172	45	229
	12	9 38	-18°5	278°8	-24°7	36	331	36	191
	13	10 6	-4°8	279°1	-24°5	41	347	22	185
	14	9 37	+8°0	278°9	-25°3	49	387	26	207
	16	11 49	+34°1	277°5	-25°7	30	296	19	189
	20	11 30	+77°0	267°9	-25°5	112	683	205	1404
Means			...	278°0	-25°0	...	...	50	364

1892 February.

Photographs were taken at Greenwich only on six days during the February appearance of the great group. On February 4 the first outliers of the group made their appearance at the East limb. On February 5 the great spot itself was seen. A period of cloudy weather then set in, and the next photograph was not taken till February 13. The group was then seen in its

full magnificence as the largest ever photographed since the beginning of the Greenwich record. The extreme length of the group was 25° of solar longitude, and that of the great spot 14° ; the greatest breadth of the entire group was 10° of solar latitude and of the spot 8° . A very considerable group, apparently corresponding to group C, lay a little to the north. The great group much resembled in its chief characteristics the great groups of April and November, 1882. Instead of a number of spots tending to stretch themselves out into a long line, and the principal members of which tend to assume the circular form, which is the arrangement typical of most considerable groups, these three great groups showed each one great irregular spot in the centre of the group, in contradistinction to the more general type, in which the chief spots are found either at the beginning or end of the group. Then these great spots each contained a number of distinct nuclei within their borders, nuclei wholly and entirely separate from each other, and not merely fragments of one nucleus cut up in appearance only by overlying bright bridges. No important change in character was noted during the succeeding days, though there was a marked diminution in area. Group C was of the usual type—a chain of spots of which the first and last were the most considerable. The spots in the middle of the group tended to die out as usual, the only departure from the normal behaviour being that in the course of events both the first and last spots were provided with a considerable companion, and the group reached the limb as a pair of close pairs. The Great Group crossed the central meridian, February $12^d 2^h$.

Group B, 1892 February.

Date, Greenwich Civil Time.	Longitude from Central Meridian.	Heliographic Longitude from Prime Meridian.	Latitude.	Projected Area.		Area corrected for foreshortening.	
				Umbra.	Whole Spot.	Umbra.	Whole Spot.
Feb. ^{h m s} 4 10 49	$-88^\circ 4$	$264^\circ 4$	$-26^\circ 4$	0	25	0	250
5 10 25	$-81^\circ 6$	$259^\circ 3$	$-28^\circ 8$	77	1144	96	1524
13 9 47	$+17^\circ 3$	$253^\circ 1$	$-27^\circ 3$	952	6274	536	3528
16 9 40	$+56^\circ 2$	$252^\circ 6$	$-26^\circ 5$	331	2919	300	2670
17 12 10	$+69^\circ 0$	$250^\circ 9$	$-27^\circ 4$	122	1249	161	1683
18 11 58	$+80^\circ 8$	$249^\circ 6$	$-28^\circ 8$	35	635	98	1605
Means	...	$255^\circ 0$	$-27^\circ 5$	...	...	198	1877

Group C, 1892 February.

Feb. 13 9 47	$+3^\circ 7$	$239^\circ 5$	$-19^\circ 4$	164	1022	85	529
16 9 40	$+42^\circ 0$	$238^\circ 4$	$-19^\circ 6$	66	559	44	382
17 12 10	$+57^\circ 1$	$239^\circ 0$	$-20^\circ 1$	24	274	22	250
18 11 58	$+69^\circ 5$	$238^\circ 3$	$-20^\circ 1$	6	159	14	216
Means	...	$238^\circ 8$	$-19^\circ 8$	...	...	41	344

1892 *March.*

Photographs were taken at Greenwich on ten days during this appearance, the group being first seen on the East limb on March 4. It had undergone a very great diminution in size since February, its area on March 4 being only 158 millionths, as against the 3528 millionths of February 13. It, however, steadily increased in size till it reached the central meridian on March 10^d 10^h, small spots forming both in advance and behind the principal spot, and tending to coalesce with it. By March 12 the group consisted of a large spot followed by a train of small faint spots. By March 14 the leader showed signs of dividing into two nearly equal portions, and by March 16 the division had been completely accomplished. It is interesting to note that Group C appeared to be represented on March 16 by a pair of small spots, though no spots were visible in that region during the earlier part of the rotation.

Group B, 1892 March.

Date. Greenwich Civil Time.				Heliographic Longitude from Central Meridian.	Heliographic Longitude from Prime Meridian.	Latitude.	Projected Area. Umbra.	Whole Spot.	Area corrected for foreshortening. Umbra.	Whole Spot.
	h	m	s							
Mar. 4	11	30		-84°6	249°9	-28°8	0	44	0	158
5	9	51		-70°3	249°0	-28°5	20	147	28	208
7	9	54		-45°6	247°2	-28°5	46	716	34	813
8	10	39		-28°9	250°4	-29°0	57	856	35	521
10	11	48		+ 1°1	253°4	-27°7	163	1192	87	640
11	9	22		+ 10°0	250°4	-28°9	80	639	45	358
12	11	9		+ 24°8	251°1	-28°1	99	802	60	475
14	10	13		+ 51°7	252°2	-28°3	53	350	45	293
16	11	4		+ 75°2	248°8	-27°7	44	243	44	243
17	11	2		+ 87°0	247°4	-28°4	5	37	24	178
Means				...	250°0	-28°4	...	...	40	389

Group C, 1892 March.

Mar. 16	11	4		+ 63°5	237°1	-23°4	0	27	0	30
17	11	2		+ 76°5	236°9	-23°8	3	32	5	61
Means				...	237°0	-23°6	...	...	3	46

It may be interesting to add that though the great group did not return again, yet that during April a circular spot was seen in about the same longitude and in the same latitude as that in which group C had originally appeared, so far back as 1891 November. Later still a very considerable group has been seen

during the last days of April, and the early days of May, in almost exactly the latitude occupied by the great group during the January appearance, and in almost the same longitude as it occupied in March, whilst an examination of earlier photographs in 1891 has shown two evanescent little groups on September 27 and October 25, in the precise region which was the seat of the first appearance of the group in November last. The entire region, therefore, has been the seat of strong, intermittent, and repeated disturbance.

On a Pretended Early Discovery of a Satellite of Mars.

By Ralph Copeland, Ph.D.

In the Crawford Library of the Edinburgh Royal Observatory is a quarto pamphlet of ten leaves, the complete title of which is: "Eberhard Christian Kindermanns, Königl. Pohl. und Churfürstl. Sächsl. Hof-Math. und Astronomi, ASTRONOMISCHE BESCHREIBUNG UND NACHRICHT VON DEM COMETEN 1746. Und denen noch kommenden, welche in denen innen besagten Jahren erscheinen werden.—Dreszden, zu finden bey Gottlob Christian Hilschern, Hof-Buchhändler, 1746." Although Kindermann* thus held the post of astronomer to the King of Poland, who was at the same time Electoral-Prince of Saxony, the few observations he has placed on record have hitherto proved of very little value. Doubts, indeed, have at various times been expressed as to their general trustworthiness; nor is it quite certain that the comet of which the little book under consideration professes to treat ever really existed, although Kindermann gives the names of two persons and mentions a third by whom he alleges it to have been seen, as well as by himself. Dr. Hind, however, has succeeded in deriving a rough orbit from the fuller particulars given by Struyck, to whom Kindermann had communicated them. The tract also contains predictions of the return of three several comets, amongst them that of 1661, of which the elements, computed long previously by Halley, resemble those of the comet of 1532. Probably it was this resemblance which led Kindermann to assume their identity with a period of 129 years and a consequent return in 1790, a conjecture which, it is needless to say, was never realised.

These particulars are now of little moment, except in so far as they characterise the writer of the book, the frontispiece of which is sufficiently striking, containing, as it does, a little figure professing to show the orbit of a satellite of *Mars* discovered by the author. The encircling legend runs: "Via Luna (*sic*) Martis entdecket vom Autore den 10. Iul. 1744." On

* The Pulkowa Library contains three of his books, including the one described above.